v. 13 #11

The MONTHLY REVIEW

Published Monthly by the

American Electroplaters Society

A SOCIETY FOR THE ADVANCEMENT

OF THE

SCIENCE OF ELECTROPLATING

NOVEMBER, 1926

Entered as second-class matter, September 3, 1926, at the Post Office of Chicago, Ill., under act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926.

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Read Convention News
Toledo Branch Report

MONTHLY REVIEW

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American Electroplaters Society

Publication and Editorial Office
3040 Diversey Ave., Chicago

VOL. XIII NOVEMBER, 1926 No. 11

EDITORIAL

EDITORIAL

Hey, fellers! The last two times Editorial Staff and Publishing Committee have spoken to you relative to writing papers and to date youse fellers are still short, so to show you how easy it is to write a story the Editor writes the following:

Just picked up the dictionary and saw word, "burnish"—it is a word used by our industry—and Webster says: Polish by friction; make smooth and lustrous; polish, gloss, brightness.

Now a lot of our members can tell us a good experience on this and your cue is above paragraph.

Let us know how you start on class of work you do. Let us know why you start this way—quickest or most efficient or because of equipment—and after you tell this, tell us the lubricant used and why, length of time, amount of balls per pound. If your's is a special problem, liken it to something general, and if your story tells members something they likewise may tell you something advantageous to all of us.

Now that you know how easy it is to write a story of interest to Review readers, let's go!

To the membership:

MERRY CHRISTMAS AND A HAPPY NEW YEAR.

RESEARCHES ON ELECTRODEPOSITION AT THE BUREAU OF STANDARDS

July 1, 1925-June 30, 1926

Address by W. Blum to

American Electroplaters Society, Newark, June 28, 1926

The studies on electrodeposition at the Bureau of Standards have been conducted in order to meet the needs of the Government Departments and of the electroplating and electrotyping industries. The effort has been made in each case not only to obtain information of immediate value and applicability, but also to gain a knowledge of fundamental principles, and to develop new methods of research and testing, which may be useful to others interested in this field. In this way we hope and believe that the work will be of greater ultimate value than if it were confined entirely to actual experiments on plating.

This policy is well illustrated by the new and simple method of measuring polarization, devised by H. E. Haring, and reported briefly to the last convention of the Electroplaters Society. Since that time Mr. Haring has made a careful study of this method and apparatus and, as reported in the April 1926 Review, he has shown that with it reliable results were obtained for an acid copper solution, a nickel plating solution and a silver plating solution. As these represent the three principal types, i.e., an acid, nearly neutral and an alkaline bath, it is reasonable to suppose that it can be used in practically any plating solution. Previous studies have shown that polarization is an important factor in the throwing power and the structure of the deposits. This apparatus should therefore prove useful in such investigations. It is now employed by a number of copper and lead refineries to control the glue content of their solutions.

At the last convention we reported upon a process of chromium plating developed by H. E. Haring and applied successfully upon the electrolytic printing plates at the Bureau of Engraving and Printing. Since that time the process has been in constant use at that plant, where new and larger equipment for this purpose has recently been installed. The results have fully justified the earlier expectations. They have shown that the service of electrolytic plates coated with about 0.0002″ of chromium is at least twice that of case-

hardened steel plates and four times that of the electrolytic plates with a nickel surface. At present the larger part of the paper currency, especially of the smaller denominations, is printed from these chromium-faced plates.

This experience indicated the probable value of chromium on other printing plates used for long editions. Accordingly a few tests were made in co-operation with the International Association of Electrotypers, upon electrotypes used for printing cartons and soap wrappers. The results showed that there was no difficulty in applying chromium to plane or curved electrotypes, and that it increased their useful life to from three to seven times their normal service. As, however, regular nickel electrotypes often yield from 200,000 to 400,000 imprssions, i.e., more than are commonly required, the application of chromium is probably not warranted except for very long editions. It has, however, proven very valuable on engraved copper plates such as are used for printing Christmas cards by the plate-printing process.

The Bureau of Standards has devoted considerable study to the control of the operating conditions at the Bureau of Engraving and Printing, including methods of analyzing the chromium plating solutions and the materials used in preparing them. In general it has been found that the chromium solutions are very easily maintained, and are not as sensitive to changes in composition as the average nickel bath. The only factors that require close control are the temperature and current density. Upon printing plates or other articles of simple shapes, the conditions described in our Letter Circular 177, and published in the Monthly Review for October, 1925, are entirely satisfactory.

In addition we have plated a number of gages for use or for test by the Bureau of Standards or other government agencies. Wear tests of these gages are not complete but the results indicate that by the application of chromium the service of the gages may be very greatly increased.

As is generally recognized, the throwing power of the chromic acid plating bath is poor, so that very irregularly shaped articles can be plated only with difficulty if at all. Our study of this type of bath, which is not yet complete, indicates that this poor throwing power is due principally to the very low cathode efficiency at the low current densities

that are obtained in recessed parts. While it may be possible to secure satisfactory results on a given application by appropriate spacing of the anodes, there is little reason to believe that the intrinsic throwing power of a chromic bath can ever be made to approach that of the more common plating baths. We expect to continue our study of chromium plating, the widespread interest in which is illustrated by a very great demand for publications on this subject.

During the year a study of the acid zinc plating bath has been made by M. R. Thompson, the results of which will be reported to this convention in a separate paper. These results show that it is doubtful whether by any known methods the throwing power of an acid zinc bath can be made to approach that of a zinc cyanide solution. It is possible however with acid zinc solutions of appropriate composition to obtan much better conductivity and employ higher current densities than with the customary zinc sulfate solutions.

The International Association of Electrotypers has spent over $3,000 per year for the salary and expenses of a research associate engaged in a study of their problems. The study of nickel electrotyping solutions, conducted by J. H. Winkler, involved the application of nickel deposition, and led to the recommendation of a very simple solution, containing merely 9 oz/gal of nickel sulfate and 0.75 oz/gal of ammonium chloride. The results of this study, with directions for the operation and control of the solution, are summarized in a circular on Nickel Electrotyping Solutions, printed by the Electrotypers Association, and available for distribution by the Bureau. This investigation is now being extended to include a study of graphite for the electrotyping industry.

During recent years the Federal Specification Board has promulgated specifications for a large variety of materials purchased by Government Departments, in the preparation of which specifications the Bureau of Standards has usually taken an active part. In May, 1926, Federal Specification 411, for Silverplated Tableware, was formally adopted and is now in force for all such purchases by the Government. It is a quality specification, prepared after numerous conferences with manufacturers and with interested government departments, and after tests upon a large number of samples of plated ware.

No attempt is made in it to define the method of plating. The amount of silver specified for frequently used articles, both flatware and hollow ware, is based on an average thickness of 0.0008" or 12.6 dwt./sq. ft. For articles used only occasionally, the average thickness is to be 0.0006" or 9.6 dwt./sq. ft. The actual amount of silver required for each article is based on the measured area and the above thickness, and is rounded off to convenient values. Thus e.g. teaspoons require 6 tr. oz. of silver per gross and other standard articles in approximate proportion to their areas. Spoons and forks are reinforced with additional silver on the bearing surface. The specification also includes tolerances and methods of testing.

This specification is of interest to those platers who may be called upon to produce goods to meet it, not only for government orders, but also possibly for railroads and hotels who frequently adopt the Federal Specifications for their purchases. This specification is subject to change after a reasonable period, in the light of the experience of the manufacturers and the government departments.

At present the technical personnel of this section consists of three chemists and a laboratory assistant in addition to the section chief and the research associate of the Electrotypers' Association. As is evident from the above report there is still much work to be done on the subjects now under way, in addition to many other interesting and important problems is electrodeposition. If, e.g. through the present efforts of the American Electroplaters' Society, additional persons can be engaged for these researches, more rapid progress can be made and the field more thoroughly covered. Space and facilities are available at the Bureau for several additional persons to work on these problems.

The exact scope of the work for next year must depend on developments. Just as soon as the funds collected by your Research Committee warrant, a general conference will be held at the Bureau to discuss plans for such work. It appears probable that we will with our present force continue work on chromium plating, and will also make a study of zinc cyanide solutions. Other problems which have been suggested for study include spotting out, brass plating, and silver plating. All of these will receive consideration, especially if adequate funds are available.

The close relation in the past between the Bureau and the Electroplaters' Society has resulted in a better understanding by the Bureau of the problems of the plater, and a more direct application by the plater of the results of researches conducted here. We hope that such co-operation will be continued and will enable us to render ever-increasing service to this industry.

RESEARCH COMMITTEE PLANS

On Saturday, October 9th, several officers of the Society and members of the Research Committee met at the Bureau of Standards to discuss informally the progress and plans for the Research Fund. In addition to Dr. E. W. Washburn, Chief of the Chemistry Division, Dr. Blum and members of his section, the following persons were present at the meeting:

F. C. Mesle, President; J. H. Feeley, 2nd Vice-President; G. Gehling, Secretary and Treasurer; R. J. O'Connor, Chairman Reserach Committee; P. Sievering, Member Research Committee; G. B. Hogaboom, Chairman Publishing Committee; W. S. Scott, Member Award Committee; W. Delage, Member Award Committee; G. Dubpernell, New York Branch; H. Seaser, Philadelphia Branch; T. F. Slattery, Bureau of Engraving.

After a general discussion, it was agreed that in order to raise the balance of the $10,000 per year, it would be necessary to interest both the plater and the superintendent or other responsible heads in each firm. To do so, it was decided to have each member of the A. E. S. furnish to the Research Committee, through his Branch Secretary, information regarding the best person in his firm to be approached.

The Research Committee will then send to each of these superintendents or managers, a letter explaining the purpose of the fund and outlining the work thus far conducted at the Bureau of Standards and the value it has been and may be to the platers and manufacturers. Each plater will then be expected to follow up this letter with a personal interview with his employer. Where such aid appears desirable the Branch will send other selected members to assist the plater in presenting the situation.

The details of the plan will be explained in letters from the Research Committee to each Branch. The purpose of this general announcement is to urge each member and each Branch officer to take a personal and active interest in this campaign so that the fund can be completed and the research work undertaken in the near future.

R. J. O'Connor, Chairman Research Committee.

CADMIUM PLATING

By H. C. Pierce

The development of cadmium as a rust preventive dates from the year 1849, when mention is first made of it in a British patent issued to Russel and Woolrich as a specific

medium for rust prevention. During the early years its electro-plating development was extremely slow—in fact, it could not be said to advance at all. This condition is easy to understand, when it is remembered that electro-plating was then in its earliest infancy. The art of electro-plating was not a steady growth, seen and understood by all, but was extremely chaotic and hidden in mystery.

Invention and the development of an art follow closely the advance of civilization. In the early days our wants and requirements were few and easily satisfied, but the time came when our requirements demanded more and better things. Invention increased, for history has shown that the need for an art or an invention invariably leads to its development.

Thus it was with electro-plating. A finish was needed which would be hard and not easily scratched. In addition this finish must be bright. This was not the case with the early cadmium deposits, which were dull and soft, and easily marred. Even the oldest of us are but children, and what child is not immediately attracted by a brightly shining bit of glass, or a gaudily colored stone.

Nickel filled these requirements and so followed the development of nickel-plating.

The demand for a metal which would withstand the action of foodstuffs in storage or for cooking led to the tinning of cooking utensils and containers.

Large amounts of iron and steel needed protection from atmospheric corrosion, not only because rusty articles are unsightly and quite often dangerous, but because the blast furnaces and foundries of the country could not supply the demand, unless the life of the article they produced could be artificially prolonged. Finish was not so important here as was the ability to prolong the useful life of the fabricated iron or steel article. Thus the early development of hot galvanizing to cover this need.

Each and every element has its own particular properties which make its use unsurpassed in many particular fields. Again, it may be only a temporary expedient to be used until a better process is developed, or the demands of society may become so rigid that it must give way to a process developed to fill the need of the moment.

This leads us down to cadmium. Its properties had long been known, but certain inherent difficulties in its refining caused a scarcity of the metal or its salts, which prevented its development beyond a test tube stage. Zinc, on the other hand, was very abundant and easily refined, so its early use was to be expected. The law of nature was inexorable, however, and the refining and electro-deposition of cadmium was developed to take its natural place in commercial fields.

Cadmium is a white crystalline metal, fairly soft, but harder than tin or zinc; more tenacious than tin; malleable and very ductile. It is only slightly tarnished by air and water at ordinary temperatures. When ignited it burns to brown cadmium oxide. Cadmium dissolves more slowly than zinc in hot moderately dilute H Cl or H_2SO_4 with evolution of hydrogen; much more readily in nitric acid with generation of nitrogen oxides. It is soluble in ammonium nitrate, forming cadmium nitrate and ammonium nitrate. Cadmium is insoluble in caustic alkali soltuions. In this latter property it differs markedly from zinc, which dissolves in aqueous alkalis with evolution of hydrogen. $Zn + 2\ Na\ OH = K_2\ Zn\ O_2 + H_2$. Cadmium is diamagnetic and has a specific resistance of 6.2 microhms per C. M.

The electro-chemical behavior of cadmium is very similar to that of zinc. Its deposition from solution by the electric current does not present such difficulties as the former metal, however, since its electrolytic potential on the hydrogen scale is only 0.42 volt, while the electric potential of zinc is 0.77 volt (Rideal, page 68).

Under ordinary conditions a soft white deposit is obtained, which can be colored only with difficulty.. During deposition, cadmium has a tendency to develop a macrocrystalline structure. This tendency may be corrected by the adoption of a complex electrolyte, by the addition of suitable addition agents, or both.

The question of porosity of coat is a very important one as its performance in the weather depends partially upon its continuity. Prof. W. D. Bancroft's book, "Applied Colloid Chemistry," 1921 edition, page 314, refers to the thickness of films of metal deposited electrolytically on platinum which give the same electromotive force as the massive metal itself. Oberbeck, the author referred to, indicates he found values of 2-3 u u for zinc and 1-2 u u for cadmium. The value

of u u is .000001 mm. This indicates that a thin film of cadmium from 50% to 33% less in thickness than a zinc film is less porous than the zinc film.

Each little pore, which may vary in size from 5 to 16 u u, acts as a capillary and is thus a very active local galvanic cell. Hydrogen is liberated at the iron and oxidation occurs on the protecting medium, either zinc or cadmium. As long as the outer protecting film is present, this outer film continues to oxidize instead of the iron. As the position of metals in the electromotive scale is increased from each other, the E. M. F. increases and the rate of action or solution of one of the other metals of the little local galvanic couple increases. Zinc is several steps ahead of iron in this scale and there is a definite difference in potential between them. Cadmium is less distant from iron but still ahead of it. Therefore the difference in electromotive force between cadmium and iron is less than between zinc and iron. There fore the rate of corrosion of the cadmium when the joint couple is wet with an electrolyte is less than in the case of zinc.

A point of interest in connection with the electrodeposition of cadmium is the smaller variation in thickness on flat pieces and particularly on irregularly shaped pieces. In order that the current will not concentrate on the near points of the cathode at the expense of the distant points, it is necessary that the solution resistance be quite low, and that overvoltage and polarization effects be quite high. This condition exists in cadmium solutions of the double cyanide type. Here the throwing power is very good and there is little or no tendency to tree.

Most of the metals deposited on iron or steel form coatings very simple in structure. With cadmium this case is quite different, particularly if the coat be given an after heat treatment. If the heat treatment is omitted, the cadmium alloys with the iron of the base to such a very slight extent that any change in the microstructure of the resulting coating is very difficult to detect. The after heat treatment, however, causes the formation of a coating relatively complex in character.

The permeation of one metal by another metal has long been known. The best known example is the permeation of

lead by gold. If a strip of lead and a strip of gold be clamped tightly together, so that they are in intimate contact, gold will be found at a considerable depth in the lead strip even after a short time of exposure.

A steel plate was covered with a cadmium coat approximately .0004" thick. This plate was now baked for two hours at a temperature of 250° C., which is much below the melting point of cadmium. An oblique cut was now made and the edge polished, then etched with a solution of KI in I, and then photographed. This photograph showed clearly the following zones: A thick outer layer of pure etched cadmium, by calculation found to be approximately .0002" thick; a thinner middle layer, presumably a high cadmium, low iron alloy, approximately .000143" in thickness, and a very thin innermost layer, approximately .00005" in thickness.

Unlike Fe Zn_3 and Fe Zn_7 formed during the process of sherardizing or hot galvanizing, these intermediate alloy layers do not seem to be any more brittle than the outermost cadmium skin. Therefore articles which have been cadmium plated will stand considerable sharp bending without separation of the intermediate layers from the base metal.

Cadmium is plated commercially from a cyanide solution. Deposits from such a solution are usually dense, fine grained and adherent. Deposits from an acid sulphate solution were usually coarse grained and very rough. The throwing power of the sulphate cadmium solution was also very poor, compared to the cyanide solution.

A sulphate cadmium solution has recently been worked out by us, which has a high throwing power, a very fine grained deposit, and a very high lustre as it comes from the plating solution.

Cadmium solutions are made by dissolving either cadmium cyanide or cadmium oxide in sodium cyanide, and then adding an excess of free cyanide. With cadmium oxide the following reaction occurs:

$4\,NaCN + CdO + H_2O = Na_2Cd(CN)_4 + 2\,NaOH.$

The salt $Na_2CD\ (CN)_4$ yields the ion $[Cd\ (CN)_4=]$. The mathematical equation expressing the equilibrum condition for the complexion is: $[Cd++] \times [CN-] = K$ instability $=$

$$\frac{}{Cd\ (CN)_4=}$$

1.4×10^{-17} which gives a definite measure of the stability of this complex ion. It is clear that the larger the constant the more unstable the complex ion would be.

A solution which contains only a few metal ions, but a large amount of dissolved salt to furnish a fresh supply of ions as fast as they are removed, is an ideal solution for the production of fine grained deposits. The concentration of cadmium ion in a 0.1 molar solution of the salt has been found to be approximately 8×10^{-5}.

When cadmium oxide or cadmium hydrate is dissolved in potassium cyanide, it is definitely known that the salt K_2 Cd $(CN)_4$ is formed. For several years it was assumed that if sodium cyanide was substituted for potassium cyanide, the equivalent salt Na_2 Cd $(CN)_4$ would be formed.

Somewhat recently the question was brought up as to whether the salt Na_2 Cd $(CN)_4$ or the salt Na Cd $(CN)_3$ was formed. Experiments were carried on in our laboratory and it was found to be essentially the salt Na_2 Cd $(CN)_4$ with possibly small amounts of the salt Na Cd $(CN)_3$ present.

Several crystals of the salt were isolated and studied carefully. The crystals obtained were flat, clear yellow in color and perfect hexagon in shape.

The early cadmium solutions were prepared without any free cyanide. Insoluble anodes were used, as in this type of solution metallic cadmium anodes polarized very rapidly. Eventually this solution was developed to a point where metallic anodes could be used. A free cyanide content of approximately 2½ ozs. per gallon was found to be the minimum which could be used without likelihood of polarization. Results of maximum efficiency are obtained today with a free cyanide content between 5-6 ozs. to the gallon.

During the transition period of plating, using insoluble anodes, all plating was of course done from the solution, which meant that the solution must be maintained by the addition of salts, either cadmium oxide or cadmium hydrate.

Various methods of adding these salts were used, such as adding them directly to the plating solution, or dissolving them in cyanide in a separate container and then adding the dissolved mass to the plating solution. The attempt was even made to fill cloth bags with the cadmium salt, and suspend these bags in the solution, the rate of solution being

slow enough to hold the metal content fairly constant.

No satisfactory addition agent had yet been found for cadmium, so the deposit obtained was soft, dull grey and buffed only with difficulty. A sample solution made up one day gave a very lustrous deposit which buffed to a high color with very little effort. Several days were expended in research and many sample solutions were made up and discarded before the answer to this phenomenon was found. Cadmium oxide had been added to this solution in a bag made from a portion of a woolen blanket. The caustic soda formed during the reaction of cadmium oxide with sodium cyanide had dissolved the wool in the blanket. This was a wonderful addition agent for cadmium.

A solution of considerable volume was at once made up, the yarn from a grey wool sweater being used as the brightening agent. The chief difficulty with the use of wool as an addition agent was the fact that it was difficult to introduce into the solution and get consistent results. If introduced directly into the plating solution, several days might elapse before it dissolved completely and began to function. The method which gave quickest results was to put the wool into a solution of caustic soda, heat to a certain temperature and then add the entire mass to the plating solution. A slight variation in the temperature would give very erratic results.

From this curious and accidental discovery of an addition agent, research led to the discovery of more and better addition agents. Casein, condensed milk, licorice powder and powdered tobacco were all used in turn, only to be abandoned in favor of the highly efficient addition agents used today by the Udylite Process Company.

As previously noted in this article, caustic soda is formed when cadmium oxide is dissolved in cyanide. This caustic soda slowly absorbs carbon dioxide from the air and changes to sodium carbonate, as noted by the following formula: $2\ Na\ OH + CO_2 = Na_2\ Co_3 + H_2O$. A number of formulas for cadmium plating have been published, and many have specified the addition of certain amounts of caustic soda to the original solution. This, of course, was in addition to that formed during the reaction of cadmium oxide and sodium cyanide, which meant that eventually the carbonate content

of the plating solution was greater than it would otherwise have been.

A considerable carbonate content has no detrimental effect in a cadmium plating solution, but it is possible for it to build up to a point where, on a cool morning, it may crystallize out and so cause trouble.

Using the same current density, cadmium deposits much more rapidly than the other common metals electrodeposited today. For example, one ampere flowing for one hour will deposit 2.0967 grams cadmium, 1.2194 grams zinc, 1.1858 grams copper and 1.0946 grams nickel. Assuming that a cadmium solution and a zinc solution has the same cathode efficiency—which is practically true, being nearly 90%—and that the same current were flowing through both solutions, if it took 14 minutes to deposit a film of cadmium .0002" in thickness, it would take 24 minutes to deposit the same thickness of zinc.

"CHEMISTRY—ITS VALUE TO THE MODERN PLATER"

S. T. Lunbeck

The plater of the old school, that man of wonderful judgment and ingenuity, who could tell by looks, taste or smell how many handfuls of this or that, how many cups of another were needed to keep his solutions in working condition, who originated new finishes or matched another by using certain chemicals, but could not tell you why he selected that particular kind only that his instinct prompted him to try it, sometimes it worked and sometimes it failed, who did not know a volt or ampmeter from a steam gauge, finds a new problem confronting him today.

Conditions like desert sands are ever shifting and the old-timer is finding it necessary to come out of his sehll and keep abreast of the modern plater, or else drop to the rear. Here he is again showing his wonderful judgment by joining hands with the A. E. S., taking up the old problems in a new and more practical way.

The A. E. S., as all know is an educational society for the advancement of the art of Electro Plating and is striving hard to have all its members become proficient in modern plating methods. Most of the branches have in some manner secured the use of laboratory equipment and the services of

an instructor and are teaching its members Chemistry as applied to the plating industry.

It is an inspiring sight to visit one of these laboratories and see a body of men, the majority of whom are gray heads, listening attentively to some lecturer, who many times is hardly more than a boy compared to some of them, explaining to them the use and action of certain chemicals, pointing out to them the way whereby they may know and not guess at the required amount and of the result.

In the future these men are going to be far more valuable to their employers through their knowledge of the actual requirements and method of applying the same than ever before. The employer will have more respect for the plater, because he will know that he has a man that knows what he is doing and have confidence in him, knowing that he will not be wasteful but will use intelligently the material purchased for him, and also will feel more secure in boosting his products knowing that they are produced under scientific control instead of the old slipshod methods of guess work.

The plater with the new acquired knowledge of scientific control will produce a better job than ever before, will consume less material, have better production and will have more personal interest in the job. He will find that it leads him to search further into the mysteries of chemical action, become interested in keeping records, and will find that many of the problems that were turning his hair white become interesting and pleasant subjects to analyze. Let me again urge the advantages of becoming a member of the A. E. S.

DETROIT BRANCH

Minutes of Detroit Branch, A. E. S.

Educational meeting of the Detroit Branch, A. E. S., held November 5, at Detroit Testing Laboratory, with a general discussion on Nickel analysis. Members that are interested in the educational meeting would do well to get here on time, 7:30, so we can get things started. We then settled down to our regular business meeting with President J. Flannigan presiding, with 24 members present. Minutes of the previous meeting were read and approved.

Under good of the order, Chromium Plating was the subject which took up the best part of the evening. Mr. Lovering, as usual, had some fine samples of chromium which were passed around. This started the ball a-rolling, and all the members seemed to be greatly interested in chrome plating.

One of the questions asked, when plating with chromium, why is it

necessary to reverse the current? Answer: In plating steadily with chromium, using a chromic acid bath, the CrO_3 (Chromic Acid) is reduced to Cr_2O_3 (Chromic Oxide) at the cathode. A point is thus reached when the bath won't work any more. Therefore the current is reversed and the Cr_2O_3 is oxidized at the anode to CrO_3. Another member wanted a binder for nigrosine. After quite a discussion the question was not answered. Meeting adjourned at 10:45.

Chas. Mascola, Secty.

NEW YORK BRANCH

The October meetings of the New York Branch held at the World Building, Park Row, New York, were largely attended.

The discussions held at Good and Welfare proved both interesting and instructive. At the first meeting Verde Antiques were taken up and all members joined in giving various ways of getting the finish. Next, Gold solutions were discussed. The committee on the invitation to be held on December 9, 1926, reported that all arrangements are being completed for an interesting and instructive evening. The committee is trying to reach all the platers in the city who are not members and are eligible to membership in the society so an invitation can be sent them to attend the meeting.

TORONTO BRANCH

Toronto Branch held their October meeting as usual at Foresters Hall, and seemingly there are two kinds of weather which are detrimental to the attendance of the branch members, that is good weather and bad weather, but on the whole, it is doubtful if any branch can beat the Toronto members for inconsistency. The vital question of the evening was laid aside for further discussion, to determine if Toronto Branch was in a position to hold a convention in Toronto in 1928.

Letters of interest were read from outside members and a letter from Mr. Ayers, stating that he would present a paper of interest at the November meeting. One member who has been successful with the Nickel Plating of Zinc Die Castings stated that he could produce just as heavy a deposit of nickel on zinc in five minutes that would take an hour on iron or steel.

One member wanted to know the inner workings of a dynamo and the difference between a shunt wound and compound wound generator. Librarian Acheson was equal to the occasion, satisfying the member, and promised to take this as his subject at the November meeting.

Mr. James Magill, instructor of the platers class at the Technical School, spoke at length on the efficiency required by the average electroplater and commended the class for their co-operation.

Just as President W. S. Barrows announced the subject for discussion, in walks our old friend, Earnie Coles, whom we had not seen since apple blossom time, and right here was a momentary study for a psysiologist with the disappointed expression as he glances over to the vacant bench usually occupied by Tom O'Keefe, Cresswell, Armstrong and Coy.

A discussion on Nickel Solutions took up the latter part of the

evening. A Nickel Sol made up of Nickel Sulphate, Nickel Chloride, Sodium Chloride, and Magnesium Sulphate, after running for about a year, sample was taken and in the analysis all trace of the Magnesium Sulphate was lost.

Question: What became of the Magnesium Sulphate? Most of the members thought Magnesium Sulphate was plated out, others thought it was taken up with the chlorides.

Question: Is there a difference in formula of Boracic Acid powdered and Boracic Acid crystals?

Answer: Same formula for both.

Meeting adjourned at 11 p. m., which was one of the best that was ever pulled off at 22 College St. J. S. Cairns.

BRIDGEPORT BRANCH

Regular monthly meeting of the Bridgeport Branch was held at their rooms, 62 Cannon Street.

The meeting was called to order with President Ray O'Connor presiding and all officers present.

The attendance was fair.

The Bridgeport Branch are trying to get more attendance at their meetings, so they have decided to try and get speakers to come and get us more interested. Messrs. Oberender and Straton were appointed as a speakers' committee.

Mr. Ray O'Connor gave us a very interesting talk on his trip to Washington, D. C., and also gave us some facts about what the Research Committee are trying to do.

It was decided that on our next open meeting, December 10, 1926, that Mr. George Hogaboon would be with us, so let's all be there for we know what George can do.

Meeting adjourned at 10 o'clock.

NEWARK BRANCH

Newark, N. J.

Newark Branch held its business meeting on Friday, October 15, President Geo. Onksen presiding, all officers being present and 18 members being present. It was decided to rent Franklin Hall at 41 Franklin St., for our meetings, where much larger quarters will be at our disposal. All Newark Branch members and their wives will, on Saturday evening, November 6, be given a supper at the Elks' Club, compliments of the Convention Committee.

Messrs. Sizelove and Stout spoke on Bright Nickel Plating.

Mr. Dulje described his Cadmium plating solutions which he is using.

Mr. Groh spoke upon the bluing of steel with the aid of heat and lime.

Mr. Glickenhaus described his method of producing a black finish on steel.

Mr. Philip Sievering spoke on Cleaners.

Meeting adjourned at 10:15 p. m. Royal F. Clark, Secy.-Treas.

On Friday, November 5th, Newark Branch held its meeting in Franklin Hall, our new meeting room, which is much more spacious. President Onksen opened the meeting with 27 members and visitors, and all officers present. Mr. Charles H. Proctor, founder of the A. E. S., was present and gave a short talk. Routine of business was quickly cleaned up and being the educational meeting, Librarian Calabrese started discussion on additional agents to a brass solution, maintaining that ammonium chloride, aqua ammonia, or caustic soda were unnecessary when the electrolyte is controlled by chemical analysis.

Messrs. Proctor, Matts, Sizelove, Bohler and Clark entered the discussion, maintaining that additional agents were beneficial and at times necessary.

Mr. Sievering stated that he has been using ammonium chloride in brass solutions for the past 35 years and advocates its use; also that the only strides made in electroplating solution is the present-day cleaners which supercede the "Potash cleaner;" and the addition of ammonium chloride to brass solutions.

Royal F. Clark, Secy.-Treas.

HARTFORD—CONNECTICUT VALLEY BRANCH

Report of September Meeting

Hartford—Connecticut Valley Branch held its first fall meeting in Springfield, Mass., on September 27th, with an attendance of thirty-one.

Mr. Frank Clark, who has recently returned from a trip to Europe, spoke on conditions in the plating shops of England and France. Mr. Clark's description of the methods employed in these places was very interesting.

Mr. H. D. McLeese next spoke on "Chromium Plating," giving a brief history of the process and telling of the various uses that had been found for this finish. Some beautiful samples of chromium plated work were shown.

It was proposed by President Kennedy that the Springfield members form a class to study the chemistry of plating, and he volunteered to secure an instructor. Several members announced their intention of joining it.

Report of October Meeting

The October meeting was held at the Hartford Electric Light Co., Hartford, Conn., on October 25th, and was largely attended. Mr. Chas. H. Proctor was present and he gave a splendid talk on "Cadmium Plating," which aroused much interest. Mr. Proctor was kept busy answering questions until a late hour.

T. Elwin, Secy.

TOLEDO BRANCH

The regular meeting of Toledo Branch, A. E. S., was held October 7th, at No. 10 S. Superior St., which is now our regular place of meeting. We had the largest attendance in the history of our Society, fourteen members being present, which isn't half bad, considering that our

total membership is only twenty-one, four of whom live in distant cities.

The meeting was called to order by President Cope, and the entire evening was devoted to making arrangements for the coming convention to be held here June 29th, 30th, July 1st and 2nd, inclusive. The following officers and committeemen were elected:

Chairman, Henry Schuldt, 154 Gradolph St., Toledo, Ohio; Secretary, Lester D. Cope, Route 8, Box 664, Toledo, Ohio; Treasurer, Ed. St. Arnaud, 3839 Willys Pkwy., Toledo, Ohio.

Publicity and Education: Howard L. Myers, 624 Southard Ave., Toledo, Ohio; John Stein, James Lee.

Hotel and Banquet: James E. Nagle, 209 Navarre Ave., Toledo, Ohio; Walter W. Weiker, E. St. Arnaud, Wm. Whitaker, Thos. De Christopher, Nicholas Kiefer.

Reception Committee: Frank L. Pierce, 1150 Woodland Ave., Toledo, Ohio; H. Wandtke, C. Snyder, W. Walinski, D. P. Ryan, Wm. Grob, J. Hilfinger.

Toledo being centrally located, we are planning on a large delegation and are starting our work early so as to have the stage all ready for them when they arrive. We are going to do all that is humanly possible to make this convention as successful as they have been in the past.

Yours very truly,

Walter W. Weiker, Secretary.

PHILADELPHIA BRANCH

The regular meeting of the Philadelphia Branch was held on November 5, at the Harrison Laboratory, U. of P.

President Gehling presiding.

Two candidates were elected to active membership.

One application was received.

The letter from Mr. O'Connor, chairman of the Research Committee, was read, and Mr. E. R. Clark, chairman; E. T. Homan and S. T. Lumbeck were appointed as a committee to supervise the work to be done in Philadelphia.

The committee that was appointed by the Philadelphia Branch to go to Washington and attend the Research Conference submitted the following report:

A few years ago the activities of the Bureau of Standards at Washington, D. C., were curtailed due to President Coolidge's economy plan. The Electro-Plating Division found their financial appropriations insufficient to maintain their standard of efficiency. Incidentally this was felt by the Electro-Platers' Society as a lot of our technical information is derived from this source.

About two years ago the Supreme Society came to the conclusion that the only possible manner to overcome this obstacle is to take charge and finance the majority of the activities of this division at the bureau. So a Research Committee was appointed to formulate plans to meet the deficit of the bureau if they continue the work we outline for them.

The conclusions of this committee found it possible and feasible to correlate a three year membership fund for those interested in this work. This three year fee being the nominal sum of $150.00, and can be paid in yearly installments. This seemed to be approved by the manufacturers and the branch societies, and payments seemed to come in admirably.

On October 16, representatives from the various branches of this society met at the bureau to outline the procedure of work to be done with the money, but it was found that the money received from this source was insufficient to proceed with the plans formulated by the society representatives, so at this meeting the committee reviewed the past work of the previous committee that was appointed by the supreme society. The new committee inaugurated a new system so that the society as a whole will function as one unit so in a reasonable time the work of the committee will be seen along this new method.

It was found at this time that the Research Committee had $3,800 in this fund, of course this is insufficient to proceed with the work we have in mind. Mr. Gehling proposed or insisted that a chemist be put to work at once with the money we have in this fund. It was his idea that if we had some action or a little activity along this line we have in mind. Mr. Gehling proposed or insisted that a chemist turers, showing that we are developing the idea we are endeavoring to sell them. The committee accepted this suggestion and by the first of January the American Electro-Platers' Society will have a chemist at the Bureau of Standards working out problems and being compensated from the society fund.

Your representatives from this branch went to Washington with the idea they were to formulate plans for the work to be done for the society as a whole, but as previously stated it was found that sufficient funds were not available to place three chemists at work immediately so the committee's work was to draw up plans to secure the deficit.

The educational report of the Electro-Chemical Society's meeting in Washington was given by Mr. W. M. Scott.

This report proved to be very interesting. A few of the important subjects which were brought out very clearly were:

Electrolytic Iron, Acid Zinc Plating Bath and Cadmimun Plating.

During the Educational Committee's report President Gehling made a strong appeal to the non-attending platers of Philadelphia to avail themselves of the opportunity of advancing themselves in the knowledge of chemical analysis and chemistry pertaining to electro-plating.

Mr. Gehling was very impressive with his sincerity on the topic of Education, he pictured the possibilities of the future to those who do not avail themselves of the opportunity offered them at our class at the Kensington Evening High School. The instructor, Mr. W. M. Scott, gave a report of the progress of the classes, he stated the elementary and the advanced classes are now in the laboratory conducting analysis.

The Banquet Committee reported everything ready for our annual meeting on November 20. A resolution was presented by President

Gehling and Messrs. Dinan, Barr, Homan and Lumbeck to elect our Phil (Philip Uhl), prominent in the Electro-Platers' Society, and who has served not only the Philadelphia Branch as secretary and treasurer for the past 15 years but has also been president of the Supreme Society, to honorary membership in the Philadelphia Branch.

The resolution was adopted by a rising vote of the meeting.

Our Phil was so greatly touched by the above action of the branch that he could hardly talk loud enough to express his sincere thanks to those who have recognized his hard work during the past 15 years for the benefit of the society.

It was also ordered that the same be engrossed and presented to Mr. Uhl.

After a lengthy discussion on what is a good formula for a nickel solution for barrel plating the meeting adjourned until Friday, December 3.

CHICAGO BRANCH

Regular monthly meeting, Chicago Branch, A. E. S., was held November 13, 1926.

The meeting was called to order with President Jacob Hay presiding and all officers present.

President Hay appointed Mr. F. J. Hanlon, Mr. O. E. Servis and Mr. R. J. Hazucha to act as a committee on the Research Drive Fund.

Mr. H. A. Gilbertson, chairman of the Banquet Committee, reported that the same will be held January 29, 1927, in the Red Lacquer Room of the new Palmer House.

The educational session to be held in the Foyer Room in the afternoon; the music is to be furnished by the Benson Orchestra, one of Chicago's finest, along with several high class entertainers.

Our librarian called upon the members for papers for the educational program and received several promises.

Balance of the evening was given over to the librarian, who found the following questions in the question box:

Question Box Chicago Branch

Question No. 1. What is the best black on aluminum?

Answer: Black nickel was recommended.

Question No. 2. Can aluminum be copper plated so it can be afterwards coated with tin, in a hot dip?

Answer: It was thought that the same would not be successful owing to the expansion under heat.

Question No. 3. What is a good black to put on a combination of die casting zinc base and steel parts to prevent corrosion?

Answer: Zinc plate and black nickel; copper plate and oxidize was recommended.

Question No. 4. Which is the best anode to use in a still plating brass solution—brass or copper anodes?

Answer: This caused a lively discussion and consensus of opinion was 50 per cent of the members favor copper anodes, 50 per cent for brass anodes of 80 per cent brass and 20 per cent zinc.

ELECTIONS

Robert Rutherford, 135 17th Ave., Newark, N. J.....Newark Branch
Louis Steeber, 331 S. 6th St., Newark, N. J.....Newark Branch
Alf. G. Smith, 16 Ragina Ave. N., Hamilton, Ont....Toronto Branch
Alexander Jackson, 1218 Ashland Ave., Detroit, Mich..Detroit Branch
John H. Helfinger, 1619 Dorr St., Toledo, Ohio.....Toledo Branch

REINSTATEMENTS

Leo Schmidt .....Chicago Branch

RESIGNATIONS

M. W. Cox, 459 Church St., Toronto, Canada.....Toronto Branch
Albert Stringer, 760 Breckenridge, Ferndale, Mich.....Chicago Branch
Frank A. Pauly .....Bridgeport Branch
Tilton D. Munson .....Bridgeport Branch

APPLICATIONS

Fred C. Hurst (Active).....Newark Branch
Leslie B. Fowler (Associate).....Newark Branch
George J. Kink (Active).....Newark Branch
George Berduxe (Active).....Newark Branch
Earnest Gilman (Active).....Chicago Branch
John McCarthy (Active).....Chicago Branch
Steve Gerloski (Active).....Chicago Branch
Armour L. Walker (Active).....Chicago Branch
Clarence M. Rames (Active).....Chicago Branch
Henry C. Alt (Active).....Chicago Branch
George H. Mamerow (Associate).....Chicago Branch

TRANSFERS

Nikolas Di Cesare.....From Chicago to Milwaukee Branch

THE CHICAGO BRANCH
of the
AMERICAN ELECTRO-PLATERS' SOCIETY
again cordially invites you and your friends to attend
THE FIFTEENTH ANNUAL BANQUET
to be held in the Red Lacquer Room of the new Palmer House, State and Monroe Sts., Chicago, Ill., on Saturday afternoon and evening,
JANUARY 29, 1927.

An interesting educational session will be held at 3 P. M., which will be followed at 6:30 P. M. by a splendid dinner, full of entertainment and concluded by dancing. Do not forget the ladies.

For reservations and further information communicate with the secretary, Mr. R. Meyers, 2432 Wilson Ave., Chicago, Ill.

Tickets $3.50 per person.

BOSTON

Regular meetings are held first Friday of each month, at 8 p. m., at the Boston Platers' Supply Co., 202 Friend St., Boston. Secretary, A. W. Garrett, 24 Juliette St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary Wm. Ehrencrona, 872 Hancock Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, Robt. Meyers, 2432 Wilson Ave., Chicago, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, Ohio.

CLEVELAND

Meets nrst Saturday of each month at Hotel Winton. M. E. Zadowski, 6517 Bridge Ave.

HARTFORD-CONN. VALLEY

Meets rourth Monday in each month alternately at 266 Pearl St., Hartford, Conn., and corner Broadway and Worthington St., Springfield. Tennant Elwin, Secretary, 117 Hobart St., Meriden, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Albert Bates, Box 34, Vandalia, Ohio.

DETROIT

Meets the first and third Friday of each month at the Detroit Testing Laboratory, 554 Bagley Ave., Detroit. Secretary, Chas. Mascola, 2041 Beard Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Saturday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, John Raven, 1139 Emerald Ave., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

MILWAUKEE

Meets second and fourth Thursdays of each month at Lipps Hall, 321 3d St. J. N. Hock, 310 Galena St., Milwaukee, Wis.

MONTREAL

Meets last Friday of month at Office of Secretary, John H. Feelay, 411 Aylmer St., Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Franklin Hall, 41 Franklin St., Newark, N. J., at 8 p. m. Secretary-Treasurer, Royal F. Clark, P. O. Box 201, Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, J. E. Sterling, 2595 45th St., Astoria, L. I.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St. Philadelphia, Pa.

PITTSBURGH

Meets first Saturday of each month at 8 p. m., at United States Bureau of Mines Bldg., Forbes St. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 184 Washington St., Room 308, Providence, R. I. Secretary, J. H. Andrew, 19 Rosedale St., Providence, R. I.

ROCHESTER

Meets every third Friday of each month at the Powers Hotel. C. A. Reama, Secretary, 512 Lyell Ave., Rochester, N. Y.

ST. LOUIS

Meets first Friday of each month at Barr Branch Library, corner Jefferson and Lafayette Sts. Secretary, F. P. Menniges, 4019 Molozan Ave.

TOLEDO

Meets first Thursday of each month at Toledo University Science Building, Electro-Platers' Room, corner Cherry and Page Sts. Secretary, W. W. Weiker, 411 3d St., Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. J. C. Cairns, 10 Wiltshire Ave., Toronto, Ontario, Canada.

WATERBURY

Meets every second and fourth Friday of each month. Secretary, Wm. F. Guilfoile, 14 Oakland Ave., Waterbury, Conn.